

**REMARKS**

This is in response to the Office Action dated October 6, 2005.

***Summary of the Amendment***

Upon entry of the amendment, Claims 1-2 and 4-7 will have been amended. Further, Claim 12-13 will have been submitted for consideration. Therefore, Claims 1-2, 4-7, and 12-13 currently remain pending.

***Summary of the Office Action***

In the Office Action, the Examiner objected to Claims 6-8 for informalities regarding the dependency of these claims. The Examiner rejected Claims 8-11 under 35 U.S.C. § 101 as improperly defining a process. Further, the Examiner rejected Claims 1-2, 4, and 8-11 under 35 U.S.C. § 112, second paragraph, as failing to set forth the subject matter which applicant regard as their invention. Finally, the Examiner rejected Claims 1-7 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,245,849 B1 issued to Morales (hereinafter "MORALES").

***Traversal of Objection re Claim Dependency***

In the Office Action, the Examiner objected to Claims 6-8 for informalities regarding the dependency of these claims. Applicant has amended Claims 6-7 to correct the objected-to deficiencies noted by the Examiner. Further, Applicant has canceled Claim 8. Therefore, Applicant believes that this basis for objection has been overcome, and respectfully requests that the Examiner withdraw the objection of Claims 6-7.

***Traversal of Rejection Under 35 U.S.C. § 101***

In the Office Action, the Examiner rejected Claims 8-11 under 35 U.S.C. § 101 as improperly defining a process. Applicant hereby cancels Claims 8-11. Therefore, Applicant believes that rejection is now moot.

***Traversal of Rejection Under 35 U.S.C. § 112, Second Paragraph***

In the Office Action, the Examiner also rejected Claims 1-2, 4, and 8-11 under 35 U.S.C. § 112, second paragraph, as failing to set forth the subject matter which applicant regard as their invention. The Examiner provided specific bases for rejection with regard to each of these Claims. *See* Office Action.

With regard to Claim 1, the Examiner indicated that it was unclear what the Applicant's definition of "high-boiling" is. Applicant has now amended Claim 1 to recite that the high boiling alcohol is chosen in the group consisting of diethylene glycol or ethylene glycol or polyethylene glycol. Therefore, Applicant submits that Claim 1 now clearly defines what the term "high-boiling" alcohol encompasses and request that the rejection under Section 112 be withdrawn.

With regard to Claim 4, Applicant submits that as amended, Claim 4 is not unclear as to whether certain metals are included in the composition as claimed. Thus, Applicant respectfully requests that the rejection under Section 112 be withdrawn.

Finally, Applicant has cancelled Claims 8-11. Therefore, Applicant believes that rejection is now moot.

Applicant hereby submits amended Claims 1-2, and 4 with respect to the specific comments and rejections noted by the Examiner for each claim. The Applicant believes that such amendments remedy any ambiguity and that each claim now specifically points out and distinctly claims the subject matter that Applicant regards as the invention. Therefore, Applicant believes that this basis for rejection has been overcome, and respectfully requests that the Examiner withdraw the rejection of Claims 1-2, and 4 under Section 112.

***Traversal of Rejection Under 35 U.S.C. § 103(a)***

Finally, the Examiner rejected Claims 1-7 under 35 U.S.C. § 103(a) as being unpatentable over MORALES. Applicant now traverses this rejection and respectfully submits that the teachings of MORALES fail to teach or suggest all of the features of Applicant's invention as taught in independent Claims 1 and 5, as well as dependent Claims 2, 4, 6-7, and 12-13.

In the Office Action, the Examiner stated that "Morales, et al. disclose nanometric dimension particles (1-1000 nm - col. 7, l. 7-65) suspended in polyethylene glycol (col. 5, l. 62-

63) wherein said particles are  $\text{MnFe}_2\text{O}_4$  (col. 7, l. 11-48). A prima facie case of obviousness may be made when chemical compounds have very close structural similarities and similar utilities. "An obviousness rejection based on similarity in chemical structure and function entails the motivation of one skilled in the art to make a claimed compound, in the expectation that compounds similar in structure will have similar properties. (citation omitted) . . . The methods disclosed are not for the materials claimed but other materials listed in the Markush group wherein the aqueous slurry of particles is added to the polymeric materials and heated to  $100^\circ\text{C}$  and then to pyrolyze to  $500^\circ\text{C}$  which eventually were cooled to room temperature (col. 10, l. 25-col. 11, l. 10). Although the methods are not identical, one would be able to modify the method to optimize the materials for each application it is envisioned to be used in therefore it would have been obvious to one of ordinary skill in the art to use known processes to improve the pigment density and overall color density of the products desired." See Office Action.

A. Review of MORALES

As understood, MORALES is directed to a method of fabricating ceramic microstructures such as microcomponents having micron or submicron dimensions, which previously had not been accomplished. See MORALES, Abstract; col. 2, lines 13-17. In order to form the ceramic microstructures, MORALES teaches that a curable polymer composition is compression molded into a substrate that has a patterned relief structure on its surface to serve as a mold. See *id.* at col. 5, lines 15-35. The polymer composition is then cured to provide a hardened ceramic material, which may be planarized. See *id.* Alternatively, a paste comprising ceramic nanoparticles, binder material, and a solvent may be compressed in a mold and the solvent may be removed by vacuum or heating to harden, but not cure the polymer.

As understood, the polymer composition "is prepared comprising a binder polymer and as ceramic nanoparticles." *Id.* at col. 6, lines 14-16. Further, a solvent is used in conjunction with both the ceramic nanoparticles and the binder polymer,

The ceramic nanoparticles generally represent on the order of 5 wt. % to 95 wt. % of the polymer composition, preferably about 15 wt. % to 90 wt. % of the composition, while the polymeric component per se typically represents about 5 wt. % to 95 wt. %, preferably about 5 wt. % to 30 wt. % of the composition,

and the remainder of the polymer composition is comprised of solvent. The solvent is such that the binder polymer dissolves therein; a preferred solvent is water, but lower alkanols ( $C_1 - C_6$  alkanols, preferably  $C_1 - C_4$  alkanols) such as ethanol, isopropanol and the like may be also used. The polymer composition is typically prepared by simple admixture of the components, with the solvent added last in an amount sufficient to provide the composition in the form of a paste of a desired viscosity, suitable for application to the mold described above. The polymer composition may contain other components as well, such as additional binder polymers, catalysts, metal powders, flexibilizers, surfactants, nanoparticle surface modifying primers, etC. § *Id.* at col. 7, lines 48-65 (emphasis added).

Therefore, as understood, MORALES teaches that the polymer composition includes (1) ceramic nanoparticles, (2) a binder polymer, and (3) a solvent. MORALES also teaches that the ceramic nanoparticles may consist of  $MnFe_2O_4$ . *Id.* at col. 7. With regard to the binder polymer, MORALES teaches that “[b]inder polymers include . . . poly(ethylene glycol) [PEG]. . . .” *Id.* at col. 6, lines 62-63. MORALES further teaches that “a preferred solvent is water, but lower alkanols ( $C_1 - C_6$  alkanols, preferably  $C_1 - C_4$  alkanols) such as ethanol, isopropanol and the like may be also used.” *Id.*

Upon being combined, the composition is compressed into the mold and the entire composition is cured at temperatures of  $74^\circ C$ , which may then be stirred, oven heated at  $100^\circ C$ , and then pyrolyzed at  $500^\circ C$ . § *See id.* at cols. 10-11. Furthermore, the water is removed from the composition when the composition is cured—either by heat, vacuum pressure, or otherwise. *Id.* at col. 8, lines 5-20.

## 2. Review of Aspects of the Present Invention

As apparent from the Specification of the Applicant’s application, the current invention involves the preparation of ceramic colorants for: guaranteeing the constancy of the color of the colorant; eliminating salts of transition metals; and other advantages. Embodiments of the present invention include the use of only nanometric particles suspended in a solvent. The solvent is a high boiling alcohol such as diethylene glycol (DEG,  $HOCH_2CH_2OCH_2CH_2OH$ ) or ethylene glycol ( $HOCH_2CH_2OH$ ), or polyethylene glycol (PEG). The composition has no ionic species of transition metals present in suspension, which eliminates problems associated with toxicity. The high boiling point of the composition makes it possible to work at high

temperatures and to complex the particles being formed, so preventing their growth. The colorant may be prepared by mixing the nanometric particles with the solvent. Further, water is added to facilitate hydrolysis of salts of metals. This mixture then be heated to above 120° C for a period of time and then brought down to room temperature. The resultant solution is then used as is, or may be centrifuged and dried.

*B. MORALES Fails to Teach the Invention of Claims 1 and 5*

In the Office Action, the Examiner contended “Morales, et al. disclose nanometric dimension particles (1-1000 nm - col. 7, l. 7-65) suspended in polyethylene glycol (col. 5, l. 62-63) wherein said particles are MnFe<sub>2</sub>O<sub>4</sub> (col. 7, l. 11-48).” See Office Action. However, Applicant respectfully submits that Claims 1 and 5 would not be obvious to one of skill in the art with reference to MORALES. Further, the Examiner does not provide other references that teach, suggest, or disclose the embodiments of the invention as provided in Claims 1 and 5.

*In re Claim 1*

As amended, Claim 1 discloses, *inter alia*, a ceramic colorant in the form of a suspension, the colorant comprising particles of colorant having nanometric dimensions in which ***the solvent of the suspension is a high-boiling alcohol selected from the group consisting of diethylene glycol, ethylene glycol, and polyethylene glycol, and wherein the suspension includes an appropriate amount of water to facilitate hydrolysis.***

Applicant respectfully submits that MORALES does not teach the composition of Claim 1 because MORALES fails to teach, *inter alia*, the *solvent* and *hydrolysis* aspects of Claim 1. MORALES does not teach the *solvent* which Claim 1 recites to be selected from the group consisting of *diethylene glycol, ethylene glycol, and polyethylene glycol*. In contrast to Claim 1’s recitation of polyethylene glycol (PEG) being used as a solvent, MORALES states that polyethylene glycol (PEG) is used as a ***binder polymer***, not a solvent: “[b]inder polymers include . . . poly(ethylene glycol) . . .” *Id.* at col. 6, lines 62-63. MORALES further indicates that the “curable polymer composition” contains “ceramic nanoparticles and a curable binder polymer.” *Id.* at col. 5, lines 20-21. Thus, PEG is used as a binder polymer in the MORALES polymer

composition, and not as a solvent, as taught by Claim 1.

Furthermore, MORALES explicitly requires the use of a solvent in addition to the binder polymer in the polymer composition. MORALES is apparently clear in requiring the use of three components in its polymer composition: the ceramic nanoparticles, the binder polymer (PEG), and the solvent (possibly water or alkanols such as ethanol, isopropanol and the like). *Id.* at col. 7, lines 55-58. In contrast, the composition of Claim 1 not only uses PEG as a *solvent* (not as a *binder polymer*), but also does not require a binder polymer in addition to the solvent. In this regard, MORALES indicates that its polymer composition further requires the addition of a solvent to the admixture of nanoparticles and binder polymer *after* the nanoparticles and binder polymer have been combined:

“The solvent is such that the binder polymer dissolves therein . . . . The polymer composition is typically prepared by simple admixture of the components, with the solvent added last in an amount sufficient to provide the composition in the form of a paste of a desired viscosity, suitable for application to the mold described above.” *Id.* at col. 7, lines 54-62.

Therefore, as mentioned, MORALES not only uses PEG used as a *binder polymer*—not as a solvent, as required by Claim 1—but the polymer composition as taught in MORALES further requires the addition of a solvent such as water, ethanol, or isopropanol. *Id.* at col. 7, lines 55-58 (“[A] preferred solvent is water, but lower alkanols (C<sub>1</sub>–C<sub>6</sub> alkanols, preferably C<sub>1</sub>–C<sub>4</sub> alkanols) such as ethanol, isopropanol and the like may be also used.”). Applicant respectfully submits that MORALES does not teach, suggest, or otherwise disclose that the *binder polymer* may be excluded from the polymer composition. In this regard, MORALES apparently requires that the solvent is always added to the admixture of ceramic nanoparticles and the binder polymer.

In contrast, Claim 1 does not require the use of the *solvent* as required by MORALES, to form embodiments of the composition of ceramic colorants as taught in Claim 1. Rather, Claim 1 indicates that the solvent is a high boiling alcohol *selected from the group consisting of diethylene glycol, ethylene glycol, and polyethylene glycol*. Thus, PEG is used as a solvent in Claim 1, and not as a binder polymer as taught by MORALES.

Additionally, Applicant further respectfully submits that MORALES does not teach the *hydrolysis* aspect of Claim 1. MORALES is completely devoid of any teaching of hydrolysis of

the polymer composition. Although MORALES requires the use of water, the water is used only as a solvent. The water is used only to aid in creating a paste of the ceramic nanoparticles and binder polymer, which paste is applied to the mold and subsequently cured. *Id.* at col. 7, lines 58-62. The water is removed from the composition when the composition is cured—either by heat, vacuum pressure, or otherwise. *Id.* at col. 8, lines 5-20. However, MORALES makes no teaching, suggestion, or disclosure of the use of hydrolysis to prepare the polymer composition.

In contrast, Claim 1 expressly requires *an appropriate amount of water to facilitate hydrolysis*. As is known in the art, hydrolysis is “a chemical reaction of a compound with water, usually resulting in the formation of one or more new compounds.” *See “Hydrolysis,”* The Columbia Electronic Encyclopedia, Sixth Edition, Copyright 2003, Columbia University Press. Indeed, while Claim 1 teaches that the water undergoes the hydrolysis reaction, and is therefore not extracted from the composition, MORALES explicitly teaches that the water is removed from the composition as one of the final steps in curing the polymer composition. *See* MORALES, at col. 8, lines 5-20. Therefore, the Applicant respectfully submits that the hydrolysis reaction indicated in Claim 1 is clearly not taught, disclosed, or suggested in MORALES.

It is possible that the Examiner may believe that the PEG used as a *binder polymer* in MORALES suggests or teaches its use as a *solvent* as recited in Claim 1. Nevertheless, the Applicant submits that the use of a polymer as a binder polymer is quite different from using the same polymer as a solvent. Regardless, the Applicant respectfully submits that MORALES is apparently devoid of any teaching of using water for facilitating hydrolysis. Importantly, the solvent used in MORALES is apparently removed from

Therefore, Applicant respectfully submits that for at least the above reasons, MORALES does not teach, disclose, or suggest the ceramic colorant as taught in Claim 1. Therefore, Applicant respectfully requests that the Examiner withdraw her rejection of Claim 1 and indicate that it is allowable over the art of record.

*In re Claim 5*

As amended, Claim 5 discloses a process for the preparation of ceramic colorants wherein the process comprises the steps of: adding salts of desired metals to a known volume of alcohol to form a solution; heating under stirring the solution to complete solubilization of the salts; and adding an appropriate amount of water for facilitating hydrolysis of the salts . . . .

As similarly indicated above with respect to Claim 1, the Applicant respectfully submits that MORALES fails to teach, *inter alia*, the hydrolysis aspect of Claim 5. Applicant therefore reiterates the arguments made above with respect to Claim 1, and submits that for these reasons, MORALES also fails to disclose the process taught in Claim 5.

1. *A Prior Art Reference (or References When Combined) Must Teach or Suggest All the Claim Limitations*

In the case at hand, the Examiner has not provided a combination of prior art references which teaches or suggests all the claim limitations of the pending claims. In rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of presenting a prima facie case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in prior art references or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Second there must be a reasonable expectation of success. *Finally, the prior art references when combined must teach or suggest all the claim limitations.* See *Litton Industrial Products, Inc. v. Solid State Systems, Corp.*, 755 F.2d 158, 164, 225 U.S.P.Q. 34, 38 (Fed. Cir. 1985) (“The references fail not only to expressly disclose the claimed invention as a whole, but also to suggest to one of ordinary skill in the art modifications needed to meet all the claim limitations”).

2. *MORALES Fails to Teach All of the Features of Claims 1 and 5*

As argued above, Applicant respectfully submits that MORALES fails to teach the *solvent* and the *hydrolosis* aspects of Claim 1 and 5. For these reasons, it would not have been obvious to one of skill in the art to modify MORALES to develop the embodiments of Applicant’s invention of Claims 1 and 5.



Applicant respectfully submits that MORALES does not teach the composition of Claim 1 because MORALES fails to teach, *inter alia*, the *solvent* and *hydrolysis* aspects of Claim 1. MORALES does not teach the *solvent* which Claim 1 recites to be selected from the group consisting of *diethylene glycol, ethylene glycol, and polyethylene glycol*. In contrast to Claim 1's recitation of polyethylene glycol (PEG) being used as a solvent, MORALES states that polyethylene glycol (PEG) is used as a ***binder polymer***, not a solvent: "[b]inder polymers include . . . poly(ethylene glycol) . . . ." *Id.* at col. 6, lines 62-63. MORALES further indicates that the "curable polymer composition" contains "ceramic nanoparticles and a curable binder polymer." *Id.* at col. 5, lines 20-21. Thus, PEG is used as a binder polymer in the MORALES polymer composition, and not as a solvent, as taught by Claim 1.

Furthermore, MORALES explicitly requires the use of a solvent in addition to the binder polymer in the polymer composition. MORALES is apparently clear in requiring the use of three components in its polymer composition: the ceramic nanoparticles, the binder polymer (PEG), and the solvent (possibly water or alkanols such as ethanol, isopropanol and the like). *Id.* at col. 7, lines 55-58. In contrast, the composition of Claim 1 not only uses PEG as a *solvent* (not as a *binder polymer*), but also does not require a binder polymer in addition to the solvent. In this regard, MORALES indicates that its polymer composition further requires the addition of a solvent to the admixture of nanoparticles and binder polymer *after* the nanoparticles and binder polymer have been combined:

"The solvent is such that the binder polymer dissolves therein . . . . The polymer composition is typically prepared by simple admixture of the components, with the solvent added last in an amount sufficient to provide the composition in the form of a paste of a desired viscosity, suitable for application to the mold described above." *Id.* at col. 7, lines 54-62.

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apparently requires that the solvent is always added to the admixture of ceramic nanoparticles and the binder polymer.

In contrast, Claim 1 does not require the use of the *solvent* as required by MORALES, to form embodiments of the composition of ceramic colorants as taught in Claim 1. Rather, Claim 1 indicates that the solvent is a high boiling alcohol *selected from the group consisting of diethylene glycol, ethylene glycol, and polyethylene glycol*. Thus, PEG is used as a solvent in Claim 1, and not as a binder polymer as taught by MORALES.

Additionally, Applicant further respectfully submits that MORALES does not teach the *hydrolysis* aspect of Claim 1. MORALES is completely devoid of any teaching of hydrolysis of the polymer composition. Although MORALES requires the use of water, the water is used only as a solvent. The water is used only to aid in creating a paste of the ceramic nanoparticles and binder polymer, which paste is applied to the mold and subsequently cured. *Id.* at col. 7, lines 58-62. The water is removed from the composition when the composition is cured—either by heat, vacuum pressure, or otherwise. *Id.* at col. 8, lines 5-20. However, MORALES makes no teaching, suggestion, or disclosure of the use of hydrolysis to prepare the polymer composition.

In contrast, Claim 1 expressly requires *an appropriate amount of water to facilitate hydrolysis*. As is known in the art, hydrolysis is “a chemical reaction of a compound with water, usually resulting in the formation of one or more new compounds.” See “*Hydrolysis*,” The Columbia Electronic Encyclopedia, Sixth Edition, Copyright 2003, Columbia University Press. Indeed, while Claim 1 teaches that the water undergoes the hydrolysis reaction, and is therefore not extracted from the composition, MORALES explicitly teaches that the water is removed from the composition as one of the final steps in curing the polymer composition. See MORALES, at col. 8, lines 5-20. Therefore, the Applicant respectfully submits that the hydrolysis reaction indicated in Claim 1 is clearly not taught, disclosed, or suggested in MORALES.

Therefore, Applicant respectfully requests that the rejection of Claims 1 and 5 under Section 103(a) be withdrawn, and that the Examiner indicate that these claims are allowable over the art of record. Furthermore, Applicant respectfully requests that the Examiner also indicate that Claims 2, 4, 6-7, and 12-13, which depend from independent Claims 1 and 5, respectively,

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are allowable over the art of record for at least the reason that these claims depend from allowable base claims.

***New Claims 12-13***

Applicant hereby submits new Claims 12-13, which depend directly or indirectly from Claim 5. Applicant believes that such claims further define and describe that which the Applicant regards as the invention. Further, Applicant believes that these claims are allowable at least for the reason that they depend from an allowable base claim. Therefore, Applicant respectfully requests that the Examiner indicate allowance of Claims 12-13.

***Application is Allowable***

Applicant respectfully submits that Claims 1-2, 4-7, and 12-13 of the present application meet the requirements for patentability under 35 U.S.C. §§ 102, 103 and 112, and respectfully requests the Examiner to indicate allowance of Claims 1-2, 4-7, and 12-13.

**CONCLUSION**

In view of the above amendments and remarks, Applicant respectfully requests the allowance of the above-identified application. Entry of the amendments and issuance of a Notice of Allowance is therefore respectfully requested. Should the Examiner have any suggestions for expediting allowance of the application, please contact applicant's representative at the telephone number listed below.

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

Date:

4/6/06

By:



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